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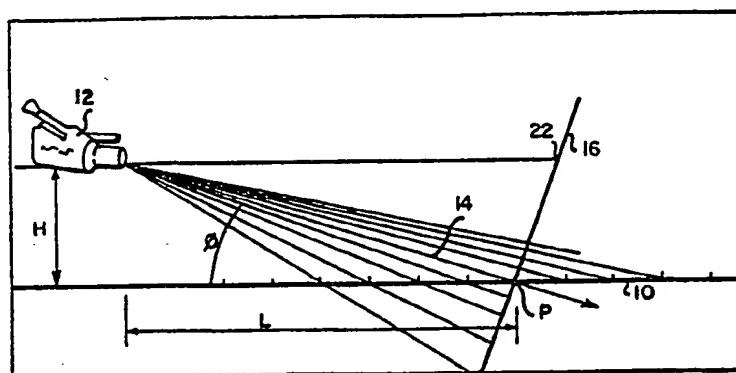
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/GB92/01538 (22) International Filing Date: 20 August 1992 (20.08.92) (30) Priority data: 91/6712 26 August 1991 (26.08.91) ZA (71) Applicant (for all designated States except US): RICHMAN, Joseph, Michael [GB/GB]; 10A Chesterford Gardens, Hampstead, London NW3 7DE (GB). (72) Inventors; and (75) Inventors/Applicants (for US only) : BROWN, Michael, John, Walter [ZA/ZA]; 33 Maynard Close, Pinelands, Cape Town, Cape Province (ZA). MERIFIELD, Michael, John [ZA/ZA]; Pierremont, Abington Circle, Fish Hoek, Cape Province (ZA).</p>		<p>(74) Agent: GODSILL, John, Kenneth; Haseltine Lake & Co., Hazlitt House, 28 Southampton Buildings, Chancery Lane, London WC2A 1AT (GB). (81) Designated States: CA, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE). Published With international search report.</p>

(54) Title: IMAGE CONVERSION



(57) Abstract

An image, e.g. of an advertising or promotional nature, is depicted in an inverse perspective form on a playing field (10) for a sporting event. The playing field is imaged by means of a video camera (12) whose line of sight (14) corresponds to the line of sight used in transforming the image to its inverse perspective form, and the output of the camera then broadcast or diffused in a television broadcasting or diffusion service.

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IMAGE CONVERSION

THIS INVENTION relates to the depiction of images. More particularly, but not exclusively, it relates to the depiction of images of an advertising or promotional nature, at sporting events.

5 According to one aspect of the invention there is provided a method of depicting an image, which includes applying an inverse perspective transformation of the image to a surface, and imaging the surface, with the transformed image depicted thereon, by means
10 of a moving picture camera whose line of sight corresponds to the line of sight used in transforming the image to its inverse perspective form.

The following is an explanation of what is meant by an inverse perspective transformation of an
15 image. Images are often depicted on a surface in a perspective form. This gives an observer of the depiction the impression of depth. For example, lines that would, in three-dimensional space, be parallel to one another and extend away from the observer (ie would
20 lie in a plane which forms a small angle with the observer's line of sight) are, in the depiction, represented as lines that converge towards a point referred to as the "vanishing point". The vanishing point lies on a horizontal line referred to as the
25 "horizon". Likewise, points on any one of these lines that would, in three-dimensional space, be spaced at equal intervals along the line are, in the depiction, represented as points which are spaced at intervals which become progressively smaller, the greater the
30 distance of the points, in three-dimensional space, from the observer. The spacing between adjacent points tends to zero as the distance, in three-dimensional space, from the observer tends to infinity.

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When viewing such a perspective depiction, the observer, by a process of visual or mental interpretation, visualises the converging lines as being parallel to one another in a plane extending away from the observer, and the points as being equi-distant from one another. This is so even though the surface on which the image is depicted may be at right angles to the line of sight of the observer.

By an inverse perspective transformation of an image, then, is meant a transformation of the image which is such that, when the transformed image is viewed by an observer from a position in which the line of sight of the observer intersects the surface to which the image is applied at a small angle, the observer, by a process of mental or visual interpretation, visualises the transformed image as extending in a plane extending at an angle (eg right angles) greater than said small angle to the line of sight of the observer.

The image may be of an advertising or promotional nature.

According to another aspect of the invention there is provided a method of depicting an image which is of an advertising or promotional nature, which includes applying an inverse perspective transformation of the image to a surface.

Where the surface is imaged, with the transformed image depicted on the surface, by means of a moving picture camera whose line of sight corresponds to the line of sight used in transforming the image to its inverse perspective form, the output of the camera may be broadcast or diffused in a television broadcasting or diffusion service.

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The surface may be a playing surface or field for a sporting event.

The invention will now be described in more detail, by way of example, with reference to the
5 accompanying drawings.

In the drawings:

Figure 1 is a side view illustrating the principles of the invention;

Figure 2 illustrates a perspective grid and,
10 superimposed thereon, a rectangular window in a focal plane extending at right angles to an observer's line of sight;

Figure 3 illustrates the window after inverse perspective transformation thereof; and

15 Figures 4a and 4b are diagrammatic side and plan views respectively, to show the symbols used in the mathematical equations used in the inverse perspective transformation of an image from a focal plane to a ground plane.

20 In Figure 1, reference numeral 10 designates a ground surface and reference numeral 12 a video camera whose line of sight 14 extends at a small angle ϕ to the ground surface. Reference numeral 16 designates an imaginary focal plane of the video
25 camera, which extends at right angles to the line of sight 14, at a point P (the focal point) where the line of sight intersects the ground surface 10. The video camera 12 is positioned at a height H above the ground plane and at a horizontal distance L from the focal
30 point P.

In Figure 2 line ABCD indicates a rectangular window in the focal plane 16; the window having the focal point P at its centre. The window ABCD is

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superimposed on a perspective grid consisting of lines 18 and 20. The lines 18 and 20 represent lines that, in the ground plane 10, form a regular rectangular grid. The lines 18 thus converge to a vanishing point 5 (not shown) on a horizontal line or "horizon" 22.

When the perspective grid illustrated in Figure 2 is transformed to a regular rectangular grid consisting of lines 18.1 and 20.1 as shown in Figure 3, and the same transformation applied to the rectangular window ABCD, the window ABCD becomes an elongated quadrilateral window having parallel sides BC and AD and diverging sides BA and CD. This transformation is herein referred to as an inverse perspective transformation. The same transformation can be applied 15 to any design represented in the focal plane 16 in the window ABCD.

The transformation of co-ordinates in the focal plane 16 to co-ordinates in the ground plane 10 can be represented mathematically as follows, the 20 various symbols that are used in the equations being shown in Figures 4a and 4b.

A point at BX, BY in the focal plane 16 corresponds to a point at GX, GY in the ground plane 10, such that:

$$25 \quad GY = \frac{H}{\tan z} - L \quad (1)$$

where

$$z = (\phi - \theta) \quad (2)$$

$$\phi = \tan^{-1} \frac{H}{L} \quad (3)$$

$$\theta = \tan^{-1} \frac{BY}{d} \quad (4)$$

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$$d = (H^2 + L^2)^{1/2} \quad (5)$$

if BY is positive, θ is positive

if BY is negative, θ is negative

if θ is positive, $z < \phi$

5 if θ is negative, $z > \phi$

if BY is positive, $\frac{H}{\tan z} > L$, GY positive

if BY is negative, $\frac{H}{\tan z} < L$, GY negative

and

$$GX = \frac{H}{\tan z} * \frac{BX}{L + n} \quad (6)$$

10 where

$$n = BY \cos j \quad (7)$$

$$j = (180^\circ - z - g) \quad (8)$$

$$g = \sin^{-1} \left(GY \sin \frac{z}{BY} \right) \quad (9)$$

15 An image, which may be of an advertising or promotional nature, is transformed from focal plane co-ordinates to ground plane co-ordinates by an inverse perspective transformation as described above. It will be appreciated that this can readily be done by means of a computer. The transformed image is then applied
20 to the ground surface 10.

Where the ground surface is a playing field for sporting events, the transformed image may be applied to the surface by means of chalk or the like marking material. TV coverage of the sporting event
25 will cause the image to be displayed on the TV screen of every person watching the sporting event on TV. The observer will, by a process of mental or visual interpretation, visualise the image on his TV screen in

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the form the image had prior to the inverse perspective transformation and the image will thus appear to be in a plane at right angles to the observer's line of vision. This will cause the image to stand out,

5 increasing its impact on the TV audience.

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CLAIMS:

1. A method of depicting an image, which includes applying an inverse perspective transformation of the image to a surface, and imaging the surface, with the transformed image depicted thereon, by means of a moving picture camera whose line of sight corresponds to the line of sight used in transforming the image to its inverse perspective form.
2. A method as claimed in claim 1, wherein the image is of an advertising or promotional nature.
3. A method of depicting an image which is of an advertising or promotional nature, which includes applying an inverse perspective transformation of the image to a surface.
4. A method as claimed in claim 3, which further includes imaging the surface, with the transformed image depicted thereon, by means of a moving picture camera whose line of sight corresponds to the line of sight used in transforming the image to its inverse perspective form.
5. A method as claimed in any one of claims 1, 2, or 4, wherein the output of the camera is broadcast or diffused in a television broadcasting or diffusion service.

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6. A method as claimed in any one of the preceding claims, wherein the surface is a playing surface or field for a sporting event.

7. A method of depicting an image, substantially as herein described and illustrated.

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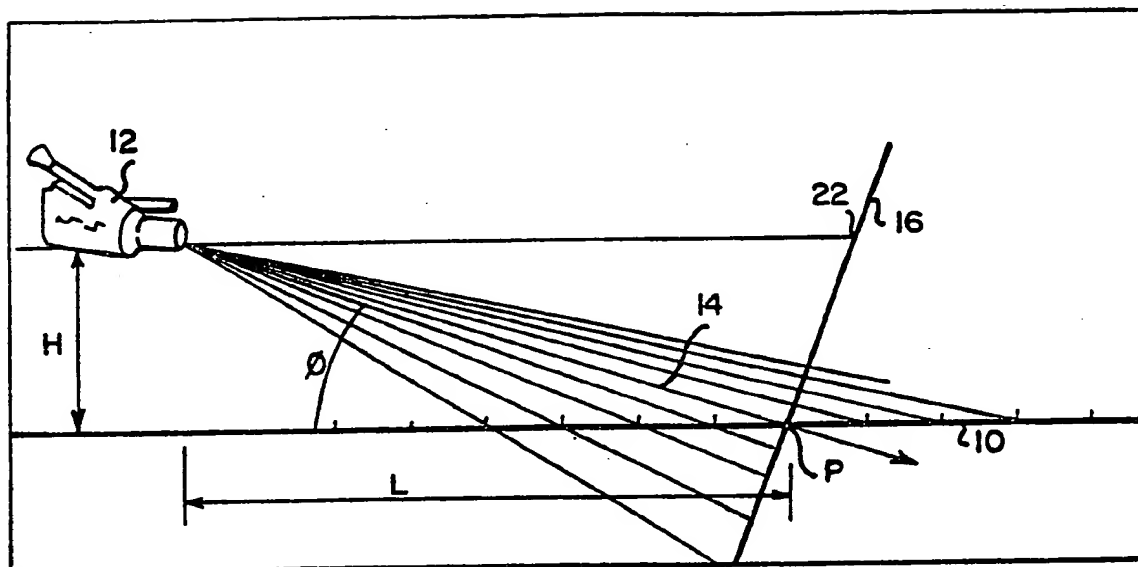


FIG. 1

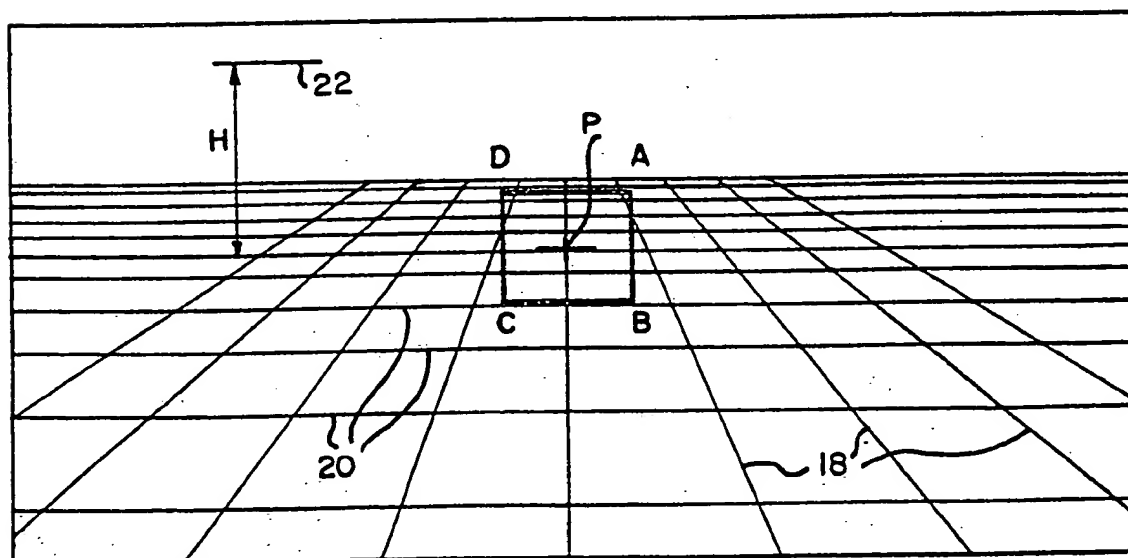


FIG. 2

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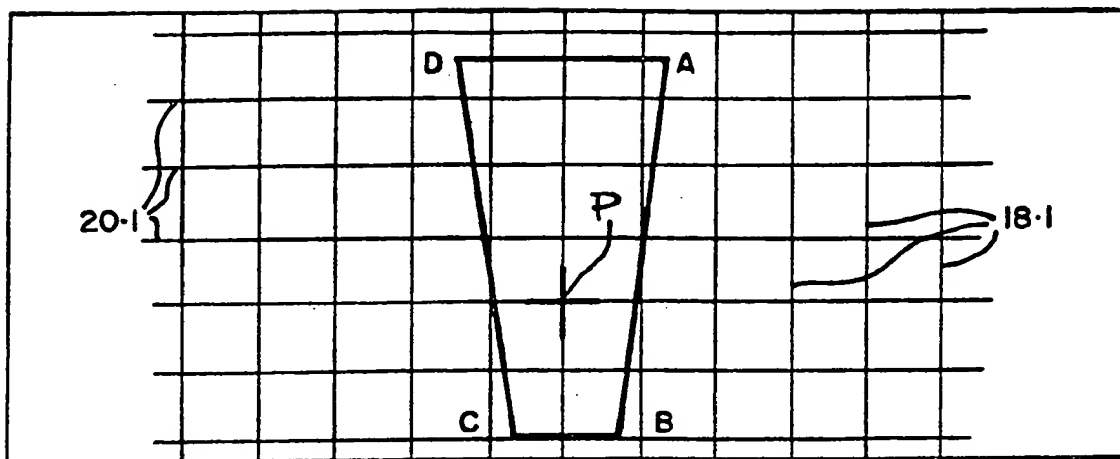


FIG. 3

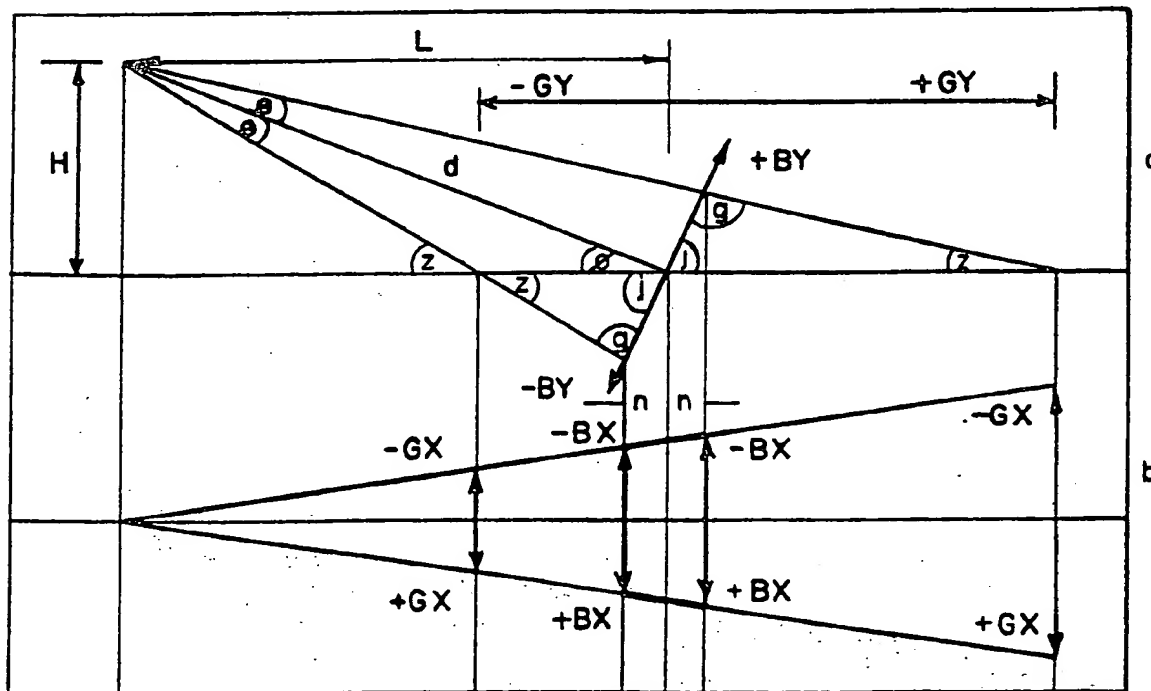


FIG. 4

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 92/01538

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁴ According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁵ : H 04 N 5/262, G 06 F 15/72																	
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Minimum Documentation Searched ¹</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; border-bottom: 1px solid black;">Classification System</td> <td style="border-bottom: 1px solid black;">Classification Symbols</td> </tr> <tr> <td style="padding: 5px;">IPC⁵</td> <td style="padding: 5px;">H 04 N 5/00, G 06 F 15/00</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ²</div>			Classification System	Classification Symbols	IPC ⁵	H 04 N 5/00, G 06 F 15/00											
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III. DOCUMENTS CONSIDERED TO BE RELEVANT³ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category ⁶</th> <th style="width: 70%; border-bottom: 1px solid black;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%; border-bottom: 1px solid black;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4 956 706 (OHBA) 11 September 1990 (11.09.90), see abstract; fig. 1; column 4, lines 13-36; claim 1. ---</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1, 3-5</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4 667 236 (DRESDNER) 19 May 1987 (19.05.87), see abstract; column 2, lines 9-59; claim 3. ---</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1, 3-5</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">US, A, 4 841 292 (ZENO) 20 June 1989 (20.06.89), see abstract; fig. 2.4, 2.5; column 11, line 47 - column 12, line 16. ---</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1, 5</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">EP, A2, 0 259 549 (IBM) 16 March 1988 (16.03.88), ---</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1, 5</td> </tr> </table>			Category ⁶	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	Y	US, A, 4 956 706 (OHBA) 11 September 1990 (11.09.90), see abstract; fig. 1; column 4, lines 13-36; claim 1. ---	1, 3-5	Y	US, A, 4 667 236 (DRESDNER) 19 May 1987 (19.05.87), see abstract; column 2, lines 9-59; claim 3. ---	1, 3-5	A	US, A, 4 841 292 (ZENO) 20 June 1989 (20.06.89), see abstract; fig. 2.4, 2.5; column 11, line 47 - column 12, line 16. ---	1, 5	A	EP, A2, 0 259 549 (IBM) 16 March 1988 (16.03.88), ---	1, 5
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A	EP, A2, 0 259 549 (IBM) 16 March 1988 (16.03.88), ---	1, 5															
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>¹⁴ Special categories of cited documents: ¹⁵</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 50%;"> <p>¹⁶ later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>¹⁷ document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>¹⁸ document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>¹⁹ document member of the same patent family</p> </div> </div>																	
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search <div style="text-align: center;">23 November 1992</div> </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;"> Date of Mailing of this International Search Report <div style="text-align: center; font-size: 1.2em;">01 DEC 1992</div> </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;"> International Searching Authority <div style="text-align: center;">EUROPEAN PATENT OFFICE</div> </td> <td style="border-bottom: 1px solid black; padding: 5px;"> Signature of Authorized Officer <div style="text-align: center;">DIMITROW e.h.</div> </td> </tr> </table>			Date of the Actual Completion of the International Search <div style="text-align: center;">23 November 1992</div>	Date of Mailing of this International Search Report <div style="text-align: center; font-size: 1.2em;">01 DEC 1992</div>	International Searching Authority <div style="text-align: center;">EUROPEAN PATENT OFFICE</div>	Signature of Authorized Officer <div style="text-align: center;">DIMITROW e.h.</div>											
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, ¹⁾ with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	see claims 1,3. -----	

ANHANG

zum internationalen Recherchen-
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ANNEX

to the International Search
Report to the International Patent
Application No.

ANNEXE

au rapport de recherche inter-
national relatif à la demande de brevet
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PCT/GB 92/01538 SAE 64370

In diesem Anhang sind die Mitglieder
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In Recherchenbericht angeführtes Patendokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
US A 4956706	11-09-90	DE A1 3920160 FR A1 2633474 GB A0 8914132 GB A1 2221118 GB B2 2221118 JP A2 2084889	28-12-89 29-12-89 09-08-89 24-01-90 09-09-92 26-03-90
US A 4667236	19-05-87	keine - none - rien	
US A 4841292	20-06-89	WO A1 8801414	25-02-88
EP A2 259549	16-03-88	AU A1 77797/87 AU B2 602002 BR A 8703888 CA A1 1289675 EP A3 259549 GB A0 8621256 GB A1 2194715 GB B2 2194715 JP A2 63065584	10-03-88 27-09-90 29-03-88 24-09-91 05-09-90 08-10-86 09-03-88 13-02-91 24-03-88